

VIII.—*On the South African Species of Peripatidæ in the Collection of the South African Museum.*—By W. F. PURCELL, Ph.D.,
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THE present paper deals with the South African species of *Peripatidæ*, as represented in the collection of the Museum. Full descriptions of the external systematic characters of three out of the four previously described species (*P. capensis*, *balfouri*, and *moseleyi*) are given, together with descriptions of four new and perfectly distinct ones. In addition five other forms are recorded, but not named, on account of lack of sufficient material.

Historical.—The genus *Peripatus* has been known from America since its first establishment by Guilding in 1826, and some years afterwards, in 1837, the first South African species was recorded and described by De Blainville as *Peripatus brevis*, with 14 pairs of legs. It was found by M. Goudot on Table Mountain, but appears never to have been met with since.

Peripatus does not seem to have been recorded from South Africa again until 1868, when Grube described three specimens found under stones on a hill at Constantia by Ritter v. Frauenfeld, during the visit of the Austrian frigate "Novara" to the Cape in October, 1857. These three specimens were named *Peripatus capensis* by Grube, and possessed 17–18 pairs of claw-bearing legs. Two of these, including those figured, belong to *Peripatopsis capensis* as at present limited, while the third belongs to the species subsequently called *balfouri* by Sedgwick.

Guilding placed *Peripatus* amongst the *Mollusca*, while Grube considered it to be an Annelid. It was not until the visit of the "Challenger" to the Cape in 1873, when Moseley obtained and dissected living specimens of *P. capensis*, that the tracheate character of these animals was discovered. Moseley obtained his specimens

mostly from rotten willow logs and stumps behind Cogill's Hotel, at Wynberg, in the Cape Peninsula, and the results of his important investigations were published in 1874 (Phil. Trans., clxiv., pp. 757-782).

In 1879 Wood-Mason described a species with 21-22 pairs of legs from South Africa, which he named *P. moseleyi*. The locality of these specimens is probably King William's Town.

In 1883 Mr. Adam Sedgwick paid a visit to the Cape, and collected a large amount of material of *P. capensis* and *P. balfouri* for embryological investigation. His material was apparently obtained from the Newlands slope of Table Mountain, and in the first part of his 'Development of *P. capensis*' (Q. J. M. S. (2), xxv., p. 450, 1885), the smaller Cape species with 18 pairs of legs was first separated as a distinct form (*balfouri*) from *capensis*. All the Cape species known to him were finally elaborately described in his 'Monograph on the species and distribution of *Peripatus*' in 1888.

Since that time no new South African species have been described. I have, however, published a notice of several of the new forms described in the present paper, but without attaching names to them (Trans. S. A. Phil. Soc., ix., pp. xviii and xix, 1897).

Classification.—In 1894 Pocock proposed to break up the old genus *Peripatus* into three genera, and introduced the terms *Peripatopsis* and *Peripatoides* as new generic names for *P. capensis* and *P. novæ-zealandiæ* respectively, while *Peripatus* was restricted to the American forms (Journ. Linn. Soc. Lond., xxiv., pp. 518-526, 1894; also in Lydekker's Royal Nat. Hist., vi., p. 288, 1896). Although Pocock's suggestion does not appear to have commended itself to subsequent authors, I believe it to be perfectly justified, and have adopted it in the following pages. The species of *Peripatidæ* are neither very few in number nor very similar in the structure of all their organs, and as these structural differences are associated with differences in the geographical distribution the establishment of several genera in the place of one becomes a matter of considerable convenience.

For instance, I am acquainted with no less than six perfectly distinct and five doubtful South African species of *Peripatopsis*, which differ from one another only in such slight characters as the number of the legs, the condition of the foot in the terminal rudimentary pair of legs, the shape of the papillæ, and the colour, while all agree closely in every other character, as far as at present known. Moreover, these eleven forms constitute a compact group,

not connected by a number of intermediate forms with the other genera.

Opposed to these forms of *Peripatopsis*, and differing from them in several more or less important characters, is another South African species, for which I have created a separate genus, described below as *Opisthopatus*.

Both these genera differ from the American forms on the one hand, and from the Australasian on the other in several characters, such as the position of the genital opening (between the legs of the penultimate pair in the American and of the last pair in the Cape and Australasian forms), and the presence (in Australian and American), or absence (in the Cape forms) of *receptacula seminis* in the female, which are surely characters of generic importance. The number of spinous pads and the arrangement of the papillæ on the feet are no doubt of less value, but as these characters go hand in hand with more important ones they are by no means to be disregarded.

Several new species have recently been described by Bouvier (*Peripatus tholloni* from Gaboon, W. Africa) and A. Willey (*Peripatus novæ-britanniæ* from the island of New Britain), which do not appear to fit into any of Pocock's genera. In that case, of course, new ones would have to be made for their reception.*

Specific Characters.—The characters available for distinguishing between the species of *Peripatopsis* are unfortunately very limited in number, almost the only ones being the number of the legs, the structure of the terminal rudimentary pair alongside of the genital opening, and the shape of the papillæ.

The number of the legs is of value apparently in all species in which there are not more than nineteen prægenital claw-bearing pairs, besides the terminal rudimentary pair—at least, no case of variation has come under my observation. On the other hand, if the number of the prægenital legs exceeds nineteen pairs, it is often no longer constant in the same species, and its value as a specific character becomes greatly diminished.

A very important character is the presence or absence of claws on the rudimentary genital legs, and I have used this to divide the genus into two main groups. The presence or absence of a rudimentary foot in the clawless forms will probably be found of specific value, although I am not yet quite sure of the constancy of this

* While this paper was in the press, A. Willey's researches on *P. novæ-britanniæ* (in: Zoolog. Results based on material from New Britain, &c., collected by A. Willey, Pt. I., 1898) came to hand. This author recognises Pocock's new names as sub-genera, and creates a new sub-genus, *Paraperipatus*, for *P. novæ-britanniæ*.

character. The number of spinous pads on the rudimentary legs appears to be always variable.

The colour is useful if associated with structural characters, although, owing to its great range of variation, it would be unwise to found a species on the colour alone. Of course exceptions to this rule may possibly occur. Species inhabiting the same locality may often be easily distinguished from one another by their colour; so, for instance, *capensis* from *balfouri* and *leonina* in the Cape Peninsula, and *clavigera* from *sedgwicki* in the Knysna.

I am uncertain to what extent the form of the papillæ of the body may be utilised, but the curious clavate papillæ of *P. clavigera* appear to form a good character, not met with in any other species of the genus.

Distribution.—The genus *Peripatopsis* is only known from the Cape Colony and Natal. If we exclude *capensis*, it may be stated generally that all the species belonging to the group with claw-bearing terminal feet occur in the western half of the Cape Colony between Cape Town and Graham's Town, extending as far north as the Cedarbergen in Clanwilliam, while the species belonging to the group in which the terminal legs are clawless inhabit Natal and the eastern part of Cape Colony, the most western locality known being the Katberg Forest. *P. capensis*, which belongs to the latter group, is the sole exception, being found in the Cape Peninsula only.

As, however, the number of localities in which *Peripatopsis* has been searched for is very small, the above limits must be looked upon as purely provisional, and they may have to be considerably modified when more forms come to light. There is little reason to doubt but that this genus or others occur in most wooded mountain ravines and in forests throughout South Africa. I have found it in nearly every likely-looking spot which I have thoroughly examined at the right season of the year.

A synopsis of the named species with their localities is given at the end of the paper.

GEN. PERIPATOPSIS, Pocock.

Journ. Linn. Soc. Lond., xxiv., p. 519, 1894 (I have not seen the original paper).

Type.—*P. capensis* (Grube).

Characters.—Legs with three spinous pads; the legs on each side of the genital opening rudimentary, very much smaller than the

preceding pair, and not used for walking, occasionally quite obsolete. Feet with two large papillæ near the apex on the anterior side and a single one on the posterior side. Genital opening always subterminal, longitudinal, never in the form of a transverse slit.

In those cases in which the male has been examined, the pair of legs immediately before the genital opening has been found to possess an enlarged crural gland. These legs are provided with a large white papilla on the ventral side in all our male specimens. The terminal unpaired portion of the *vas deferens* is not very long.

In the female there is no *receptaculum seminis*, and the oviduct contains a number of embryos, all of which are equally developed and of the same size.*

The number of legs is constant in all species, with not more than 19 prægenital pairs. In the remaining species the number appears to vary slightly. The dorsal surface is provided with a fine white median line, often only partially visible in preserved specimens. The outer jaw has a small accessory tooth at the base of the main tooth.

It occasionally happens that an apical dorsal papilla occurs on a foot here and there in addition to the one posterior and two anterior papillæ; now and then also two posterior papillæ are found on some feet.

§ 1. *No claw-bearing legs on each side of the genital opening.*

(a) *Species in which the rudimentary legs on each side of the genital opening are normally without traces of rudimentary feet, and occasionally even absent. A spinous pad is often present on these legs.*

1. PERIPATOPSIS CAPENSIS (Grube).

Peripatus capensis (*ad part.*), Grube, Anneliden, p. 4, pl. iv., figs. 3, 3a-c, in: *Reise der österreichischen Fregatte Novara um die Erde in den Jahren, 1857, 1858, and 1859. Zoologischer Theil, Bd. ii., Abthlg. iii.* Wien, 1868.

„ „ (*ad part.*), Moseley and Sedgwick, in: *Balfour's Anat. and devel. of P. capensis*, Q. J. M. S. (2),

* I found this to be the case in the female specimens of the following species, which I dissected: *capensis*, *moseleyi*, *balfouri*, *leonina*, *sedgwicki*, and *clarigera*. It must be remembered, however, that at certain times of the year a new set of eggs may have entered the oviduct before the birth of the older brood; in such cases of course there would be embryos of two different stages in the oviduct at the same time, but this is still a very different condition from that which obtains in *Opisthopatus*.

- xxiii., 1883 (pp. 3-8 of the reprint refer to *capensis* and *balfouri*, pl. xiii. and xiv. to *capensis* only).
- „ „ Sedgwick, The develop. of *P. capensis*, Pt. 1, Q. J. M. S. (2), xxv., p. 450, 1885; reprinted in Stud. Morph. Lab. Cambridge, iv., p. 2, 1889.
- „ „ Sedgwick, A Monograph on the spec. and distrib. of the genus *Peripatus*, Guild., Q. J. M. S. (2), xxviii., 1888; reprinted in Stud. Morph. Lab. Cambridge, iv., pp. 157-166, pl. xiv.-xvi. and pl. xx., figs. 27-28, 1889.

Characters.—Claw-bearing (prægenital) legs 17 pairs; the middle spinous pad not very broad, only 1.4-1.7 times as wide as the proximal pad.

On each side of the genital opening in the female is a papilliferous tubercle, which is the rudiment of the genital pair of legs. Near the apex of each on the ventral side is a small, yellowish, spinous pad. In one specimen this pad was surmounted at the apex of one of the tubercles by a movable rudimentary foot, which was provided with four papillæ on its ventral surface and the rudiment of a claw in the centre between them. Often the pad is absent, and sometimes even the tubercle itself may be quite obsolete on one side of the body. In the male the tubercle is even more reduced and without trace of spinous pad or foot.

Papillæ of the dorsal and lateral surfaces conical, high, rounded at the apex, never clavate.

Length and width of average adult ♀ (alive and extended): $58 \times 6\frac{1}{2}$ mm.
 „ „ „ ♂ „ „ 32×4 „
 „ „ of same ♀ and ♂, preserved in alcohol. sol. of HgCl_2 and contracted: 41×7 mm. and $28 \times 4\frac{1}{2}$ mm. Sedgwick gives 65 mm. for the ♀ and 48 for the ♂.

Colour of darker forms (5 ad. and 7 juv. from St. James, False Bay, and 5 ad. from Platteklip, Table Mountain).—*Dorsal and lateral surfaces* deep velvety black, often with a greenish tinge in some lights; becoming dark green after long immersion in spirits. The five longitudinal darker stripes described for *balfouri* (on p. 342) present, but, excepting the medio-dorsal one, not very distinct. The usual lateral band just above the bases of the legs on each side slightly lighter in colour than the rest of the dorsal surface and often more distinctly green in the living animal.

All the papillæ black, many of the larger tipped with orange-brown, at least along the lighter lateral bands; these orange-tipped

papillæ not markedly less numerous in the two pairs of dark lateral stripes, but sometimes almost or quite absent from the dorsal surface proper.

Outer surface of the legs often bluish black and slightly lighter than the dorsal surface of body, the papillæ black, or blue-black, a number of the larger ones orange-brown in the apical part.

Ventral surface of body generally pale orange, that of the legs bright orange, becoming after long immersion in spirits pallid, owing to the complete extraction of the orange colour. Dark pigment occurs on or between the papillæ along the median line, in the pore at the base of each leg, and often also near the posterior end of the body. Many of the papillæ of the ventral surface are partially pigmented with black. The papillæ on the under side of the head are dark green.

The under surface of the legs is either without pigment or the papillæ are more or less pigmented with black. Spinous pads yellowish green, the proximal ones often orange, becoming pale yellowish in spirits. Foot bluish grey to almost black. Claws pale at the base, dark brown at the apex.

All the *young* (2 cm. in length and under) from the same locality at St. James differ markedly from the adults in colour. The ventral surface is almost entirely free from dark pigment, excepting under the head, and generally also along the median line and in the basal pores of the legs. The upper surface resembles that of *balfouri* rather than the adult *capensis*, for the larger papillæ are much more extensively, often, especially on the sides of the body, entirely orange with a ring of dark pigment at the tips. The orange papillæ on the legs are very pronounced and numerous, resembling those on the sides of the body.

Reddish forms.—I have also examined several adult specimens from Rondebosch (*F. Treleaven*) and Newlands. In one from the latter place the orange-red of numerous large papillæ extends over their whole surface and often also round their bases, this being especially the case in the lateral band just above the bases of the legs. The dorsal surface thus acquires a distinct reddish hue, and the lateral bands appear quite red. The legs, however, remain bluish black, the orange being here confined to the apical region of the larger papillæ. The under surface (exclusive of the head) of several of these specimens is almost devoid of dark pigment, excepting along a faint median streak and often also at the posterior end of the body. A young specimen ($1\frac{1}{2}$ cm. long) from the same locality resembles those from St. James.

Mr. Sedgwick described specimens in which the dorsal surface and most of its papillæ are reddish brown, but I have not met with such cases. The same author states that the colour appears to be hardly at all affected by spirits. This is scarcely correct, for the red of the ventral surface may disappear after a few weeks, and although that of the dorsal papillæ may remain for some years, it also ultimately entirely disappears, while the black pigment becomes dark green.

Locality.—*P. capensis* is widely distributed over the Cape Peninsula. It has been found under stones in ravines on the mountain-side at St. James (False Bay), and in similar places on the Cape Town side of Table Mountain (near Platteklip). It is found throughout the woods at Newlands, Rondebosch, Wynberg, and Constantia, often in hiding in rotten tree-stumps. It is not confined to the mountain slopes, but occurs in the low-lying land as well.

2. PERIPATOPSIS MOSELEYI (Wood-Mason).

Peripatus moseleyi, Wood-Mason, Morphol. notes bearing on the origin of Insects, in: Trans. Ent. Soc. Lond. for 1879, p. 155.

„ „ Sedgwick, A monograph on the spec. and distr. of the genus *Peripatus*, Guild., in: Q. J. M. S. (2), xxviii., 1888; reprinted in: Stud. Morph. Lab. Cambridge, iv., pages 168, 169–171, pl. xvii., fig. 8.

The original diagnosis was very brief, as follows: “*P. moseleyi*, with 21–22 pairs of walking legs, from South Africa.”* Professor Sedgwick subsequently obtained and described in detail one of Wood-Mason’s specimens, together with four others in the possession of the Indian Museum, the locality of which is stated to be “near William’s Town, South Africa.” Sedgwick states that Wood-Mason’s specimen was found by Mr. J. P. Mansel Weale, but no locality is given. As Mr. Weale is known to have collected many natural history specimens from the King William’s Town and East London Divisions in the Cape Colony,† I think it highly probable that the type-specimens of this form were also found by him somewhere in these two districts.

* Were it not for Sedgwick’s subsequent description *P. moseleyi* would have remained quite unrecognisable. A diagnosis based on the number of legs alone without the exact locality is totally insufficient.

† See for instance: R. Trimen, S. Afr. Butterflies, i., p. xi., 1887.

Sedgwick has also recorded a specimen of *P. moseleyi* with 22 pairs of legs, found in the Botanic Gardens, Pietermaritzburg, Natal (in: Note on a *Peripatus* from Natal, Proc. Phil. Soc. Cambridge, vii., pp. 250-251).

Six specimens (3 large ♀, 1 large and 2 small ♂), collected by Mr. E. A. Haviland at Escourt, Natal, in 1896, are the only ones in the Museum referable to *P. moseleyi*. The colour of these specimens after immersion in spirits for nearly two years is as follows:—

Dorsal surface a uniform dark green. In one specimen the larger papillæ are paler and brownish green, especially round their bases (these and the lateral bands were probably brown in the living animal), while in another a few conspicuous bright orange papillæ occur on the anterior part of the body. Skin of head sometimes pallid between the dorsal papillæ. Of the five darker longitudinal stripes described for *balfouri* (p. 342) only the medio-dorsal one is very distinct. On each side just above the bases of the legs is the usual lighter band (generally of a paler green, but greenish brown in one specimen). Outer surface of the legs dark green, without any brown papillæ. The under surface is uniformly pale, without any dark pigment, except on the head, where the papillæ are mostly tinged with green.

All possess 22 pairs of prægenital claw-bearing legs, the feet of which are often striped on the dorsal surface with dark green longitudinal lines, just as in Sedgwick's specimens. The spinous pads are yellowish or partly green, the middle pad being 1.6-2 times as wide as the proximal pad. The rudimentary leg on each side of the genital opening is a mere tubercle without feet and with rudimentary or no spinous pad.

The papillæ of the dorsal and lateral surfaces of body high, conico-cylindrical but not clavate, mostly rounded at the apex, those in the lateral paler bands often compressed at the base (possibly on account of the contraction of the body).

Although Escourt is three hundred miles distant from King William's Town there is nothing in the nature of the intervening country to render the occurrence of the same species throughout this wide area improbable.

3. PERIPATOPSIS, spec. nov. (?).

Three specimens in a bottle labelled "Pietermaritzburg, Natal (*Col. J. H. Bowker*, 1892), with 23-24 pairs of claw-bearing prægenital

legs. Papillæ shaped as in *capensis*. Colour dark green, with the larger papillæ pale or brown. The lateral band on each side just above the bases of the legs paler green or quite brown.

It seems to me probable that these specimens belong to a distinct species, but I do not care to create a new specific name for them, as their age and the state of preservation of two of them renders them scarcely suitable for description.

(b) *Species in which the rudimentary leg on each side of the genital opening is normally provided with a rudimentary and clawless, but distinctly recognisable foot.* (On account of the state of preservation of some, and the small number of specimens at my disposal of others, I have not thought it advisable to attach new specific names to the three forms which come under this heading.)

4. PERIPATOPSIS, spec. nov. (?).

Two old specimens, labelled "Katberg Forest," fifty miles north-west of King William's Town (*W. C. Scully*, 1884), with 21 pairs of claw-bearing prægenital legs. Papillæ mostly low and stumpy, conico-hemispherical, higher at the posterior part of body. The rudimentary leg on each side of the genital opening furnished with a spinous pad and a distinct foot, the latter bearing an anterior and a posterior papilla near the apex, but no claws.

5. PERIPATOPSIS, spec. nov. (?).

A small female from Richmond, Natal (*Rev. J. R. Ward*, 1898), with 21 pairs of claw-bearing prægenital legs. Papillæ shaped as in *moseleyi*. The dorsal and lateral surfaces of the living animal were of a bright orange colour, with a black median stripe, and midway between the latter and the bases of the legs are a number of blackened papillæ, which form a dark stripe on each side. Outer surface of legs with blue-black papillæ and a few pinkish brown ones. Under surface of body pink, without dark pigment. Genital legs like those of the previous form, but the spinous pad appears to be rudimentary. I examined this specimen alive.

6. PERIPATOPSIS, spec. nov. (?).

A large male, also from Richmond, Natal (*Rev. J. R. Ward*, 1898), with 20 pairs of claw-bearing prægenital legs, was, when alive, of an almost uniform dark olive-greenish brown, with the usual black medio-dorsal stripe and a paler lateral band on each side just above

the bases of the legs. Colour of legs and ventral surface and structure of the genital legs as in the previous form. Papillæ shaped as in *moseleyi*. This specimen was examined alive.

It is a matter of uncertainty whether the two last-mentioned forms from Richmond belong to one or to two species, and whether either or both are co-specific with the specimens from the Katberg Forest.

§ 2. Rudimentary legs on each side of the genital opening furnished with perfect feet, each bearing a pair of claws.

7. PERIPATOPSIS BALFOURI (Sedg.).

Peripatus capensis (*ad part.*), Grube, Anneliden, p. 4, in: Reise der österreichischen Fregatte Novara um die Erde in den Jahren, 1857, 1858, and 1859. Zoologischer Theil. Bd. ii., Abthlg. iii. Wien, 1868.

„ „ (*ad part.*), Moseley and Sedgwick, in: Balfour, Anat. and devel. of *P. capensis*, Q. J. M. S. (2) xxiii., 1883 (pp. 3-8 of the reprint refer to *capensis* and *balfouri*).

„ *balfouri*, Sedgwick, The develop. of *P. capensis*, Pt. 1, Q. J. M. S. (2), xxv., p. 450, 1885; reprinted in: Stud. Morph. Lab. Cambridge, iv., p. 2, 1889.

„ „ Sedgwick, A monograph on the spec. and distrib. of the Gen. *Peripatus*, Guild., in: Q. J. M. S. (2), xxviii., 1888; reprinted in: Stud. Morph. Lab. Cambridge, iv., pp. 166-7, pl. xvii., figs. 9-10, and pl. xx., fig. 24.

Characters.—Claw-bearing legs 18 pairs; the middle spinous pad broad, 2-2.6 times as wide as the proximal pad.

The leg on each side of the genital opening in the female with the well-developed foot somewhat smaller, or at least shorter, than that of the preceding leg; the trunk much reduced, with one distinct or rudimentary spinous pad and sometimes with rudiments of a second, and about two rows of papillæ between the pad and the body on the median side. In the male the foot is much smaller than those of the previous pair, and the trunk and spinous pads are even more reduced than in the female. The penultimate pair of legs is also somewhat smaller than the preceding pair in the male.

The papillæ on the dorsal and lateral surfaces of body conical or cylindrical but never clavate, often conical at base and attenuated

and sub-cylindrical in the distal part; high, mostly at least as high as broad at the base.

Length and width of large ♂ (alive and extended): 32×2.1 mm.

“ “ “ ♀ “ “ “ 43×3 mm.

“ “ “ of another large ♀, preserved in alcohol. sol. of HgCl_2 and contracted: 28×3.75 mm.

Colour.—*Dorsal and lateral surfaces* dark olive-green to almost black, with five darker longitudinal stripes, viz., a narrow, well-defined, medio-dorsal stripe, divided longitudinally by a fine white line, and two broader, generally less distinctly defined, lateral stripes on each side. The lower of the lateral stripes connects the upper portions of the bases of the legs, while the upper one lies between these and the dorsal stripe, but nearer to the former than to the latter. In the medio-dorsal and lower lateral stripes there are generally no orange papillæ, although occasionally a couple may be present; in the upper lateral stripe a few orange papillæ generally occur in places, or they are entirely absent from it. The surface between the two lateral stripes forms on each side a lateral band lying just above the bases of the legs and generally of a lighter shade of colour than the broader dorsal bands, which lie between the upper lateral and the medio-dorsal dark stripes, one on each side of the latter.

The ordinary papillæ are black or almost so, many of them with a minute pallid or orange dot in the middle of the apex. Evenly distributed amongst these, except in the five dark stripes, are a much fewer number of large orange-coloured papillæ (about 40–50 to each of the 18 leg-bearing body segments). The orange colour occupies the sides of the papillæ, and generally also (but not in all specimens) spreads a little round the base, while the apex is generally dark green or black with a minute orange dot in the centre. In preserved specimens all the orange is extracted and the papillæ appear white.

The outer surface of the legs is dark green, without any green-tipped orange papillæ.

Ventral surface of body and legs in preserved specimens pallid or slightly tinged with green between the papillæ; the numerous papillæ more or less dark green, sometimes only faintly tinged. No transverse or longitudinal green stripes.

Spinous pads of legs in the living animal greenish yellow—in preserved specimens green, the proximal part of the middle pad yellowish. *Foot* a bluish or blackish grey. *Claws* pale at the base, dark brown at the apex.

Amongst the large number of specimens which I have examined, those from the following localities deserve special notice:—

(a) About forty specimens from the wooded slopes of Table Mountain at Newlands. It is characteristic of these specimens that the dark-green pigment is very often (but not always) very faint or quite absent between the dark-green papillæ on the head, and sometimes almost the whole surface of the latter, including the papillæ, is quite white and devoid of all pigment. In some specimens a large amount of orange-red pigment occurs, in addition to the colouring matter which is always present in the orange papillæ. This gives the dorsal surface a decided reddish hue, while the lighter parts (upper surface of head, ventral surface, especially of head) become bright orange-red. In one very red specimen the greater part of the head, however, was quite white in the living animal. In these red specimens the ordinary green pigment is present in the usual quantity. Orange papillæ were never absent from the dorsal surface. Professor Sedgwick appears to have obtained his specimens from this locality.

(b) About forty specimens from the mountain-side at Simons Town. In these the dorsal surface of the head is always as darkly pigmented as the rest of the upper surface. The ventral surface of the body in the living animal is pale with a bluish or pinkish tinge, that of the head orange-red. The orange pigment of the dorsal surface is confined to the orange papillæ, and is sometimes very pale. In some specimens these orange papillæ are partially or wholly blackened in some parts of the body; these form a transition to the following:—

(c) Two specimens from a ravine on the mountain-side at St. James (False Bay). In these all the papillæ of the dorsal and lateral surfaces are black, without any trace of orange.* Otherwise they resemble the specimens from Simons Town.

(d) A single female specimen preserved in spirits and found in the Cedar Mountains at the Boschkloof Waterfall, near Clanwilliam, by Mr. C. L. Leipoldt in November, 1897. The peculiarity of this specimen is the presence on the outer surface of each leg of a small number (two to four) of green-tipped orange papillæ, similar to those on the body. These are never found on the legs of specimens from the Cape Peninsula, although in these the apices of one or two of the papillæ of the legs may occasionally be orange, owing to the expansion of the central apical dot over the whole tip. The skin of

* I was formerly inclined to consider these a new species (Trans. S. A. Phil. Soc., ix., p. xviii, 1897).

the head is paler than the rest of the dorsal surface. The orange of the papillæ is still recognisable after nearly a year.

The effect of hardening agents and spirits of wine upon the colour deserves notice. At first the green tinge gives place to a deep black, only to reappear after the lapse of some months, and in course of time the dark pigment becomes a more and more decided green. Immersion in spirits for a few weeks or months further causes every trace of orange and red to disappear.

Locality.—Under stones, logs, bark, and in rotten wood on the slopes of Table and other mountains of the Cape Peninsula, and in the Cedar Mountains, Clanwilliam. I have found this species in the Platteklip Ravine on the Cape Town side of Table Mountain, in the woods on the Newlands slope, and in ravines near Camp's Bay and Hout Bay; also at St. James and at Simons Town along the False Bay coast. I have never met with it on Signal Hill, which is the home of *P. leonina*.

P. balfouri was confused with *capensis* for a long time, until Sedgwick separated it in 1885. In his original description this author states that the larger papillæ on the dorsal surface are white, and that the eighteenth pair of legs in the male is hardly distinguishable from the large papillæ found near the hind end of the body. This caused me at first to consider the specimens described above as possibly different from Sedgwick's *balfouri* (Trans. S. A. Phil. Soc., ix., p. xviii, 1897), but I am now convinced of their identity, and think it probable that that author's description was drawn up from preserved specimens only.

8. PERIPATOPSIS LEONINA, n. sp.*

Characters.—Claw-bearing legs 22 pairs in the types, 21 pairs in other specimens; the middle spinous pad very broad, 2·2–3 times as wide as the proximal pad.

The leg on each side of the genital opening as in *balfouri* in both sexes.

In the male the last prægenital pair of legs is also somewhat smaller than the penultimate pair.

The papillæ on the dorsal and lateral surfaces shaped as in *balfouri*.

Length of large ♂ (alive and extended): 34 mm.

* These specimens are referred to by me in Trans. S. A. Phil. Soc., ix., pp. xviii–xix, 1897.

Length and width of large ♀ (alive and extended) : 49×2.8 mm.
 " " same ♀, preserved in alc. sol. of HgCl_2 and contracted : 34×4 mm.

Colour.—*Dorsal and lateral surfaces* greenish black to black (becoming dark green after long immersion in spirits), with five darker longitudinal stripes exactly similar to those of *balfouri*. The lateral band just above the bases of the legs on each side lighter than the dorsal surface. The orange papillæ blackened at the apex and exactly resembling those of *balfouri* in their distribution, excepting that they are never wanting.

Ventral surface generally pink in the living animal, pale in preserved specimens, with numerous papillæ more or less tinged with dark green; traces of a dark, longitudinal, median line and dark transverse lines between the bases of opposite legs rarely present.

Legs.—Outer surface black to greenish black, without any green-tipped orange papillæ. Ventral surface like the under side of body. Colour of spinous pads, feet and claws, as in *balfouri*.

The orange papillæ of the body lose their colour much more rapidly in spirits than is the case in *balfouri*, the papillæ becoming white after a few hours' immersion. I have never noticed orange or red pigment, similar to that found in some specimens of *balfouri*, in any other parts of the dorsal surface.

Locality.—A number of males and females from under stones in the small ravines on the Cape Town side of Signal Hill (Lions Hill) during the winter months. I have never found this species on Table Mountain nor in any other locality, and it appears to be the only one inhabiting Signal Hill. Its existence there was first pointed out to me by Mr. R. M. Lightfoot.

Individuals with 22 pairs of legs were found to be just twice as numerous as those with 21 pairs; this applies to both sexes. I have no doubt as to the specific identity of both these series of specimens. Apart from the fact that I could discover no differences either in habits, colour, or structure, other than the number of legs, is the circumstance of a female with 22 pairs of legs giving birth shortly after being captured to thirteen young, two of which possessed 21 pairs of legs and the remaining eleven 22 pairs each. I have also captured a male specimen with 21 pairs on one side of the body and 22 on the other.

9. PERIPATOPSIS SEDGWICKI, n. sp.

Characters.—Claw-bearing legs 20 pairs; the middle spinous pad not very broad, 1.5–2.2 times as wide as the proximal pad.

The legs on each side of the genital opening in the female with the foot normally developed, although smaller than that of the preceding legs, the trunk much reduced but better developed than in either of the preceding species and longer than the foot, generally with two, sometimes even with three, rarely only one distinct spinous pad, and several rows of papillæ between the pad and the body on the median side. In the male the foot, pads, and trunk of the leg are much more reduced than in the female.

Most of the papillæ of the dorsal and lateral surfaces are short and stumpy with rounded apices, often conico-hemispherical, especially the larger ones of the middle portions of the body, the smaller ones, however, often sub-cylindrical in their distal part and slenderer; none are ever clavate.

Length and width of only ♂ (preserved in alc. sol. of HgCl_2 and contracted): 25×4.25 mm.

Length and width of largest ♀ (similarly contracted): 52×7 mm.

Colour of preserved specimens ($2\frac{1}{2}$ years in spirits).*—*Dorsal and lateral surfaces*: Ground colour made up of black (varying to greenish black) and orange-brown pigment. The latter predominates in the broad dorsal band on each side of the medio-dorsal stripe, and especially in the lateral band just above the bases of the legs on each side, both pairs of bands appearing orange-brown. The dark pigment predominates in five longitudinal dark stripes, corresponding to those of *balfouri*. Of these the medio-dorsal one is the darkest and narrowest, and is divided longitudinally by a fine white line, while the upper lateral stripes are very broad with numerous orange-brown papillæ.

The papillæ are black with numerous large orange-brown ones interspersed amongst them. These latter are broadly orange-brown round their bases, and mostly not green-tipped; they are evenly distributed over the whole surface, often occurring in the lower dark lateral stripe as well. In the light-coloured lateral bands the dark pigment of the papillæ is often almost entirely replaced by orange-brown.

Ventral surface uniformly pale, without pigment, or more often with dark pigment forming a faint or more or less distinct median longitudinal stripe, and transverse stripes between the bases of opposite legs.

* These specimens are mentioned in *Trans. S. A. Phil. Soc.*, ix., p. xviii, 1897. The original colour of the dorsal surface has remained practically unchanged, as far as I can recollect, although the original tints of the ventral side have probably disappeared.

Legs.—Outer surface with numerous very dark smaller papillæ and a number of large pale orange papillæ. Ventral surface without pigment. Spinous pads yellowish. Feet and claws coloured as in *balfouri*.

In some specimens the two kinds of pigments are more evenly distributed over the dorsal surface, which appears greenish brown or brownish green with the upper lateral dark stripes indistinct.

Locality.—Eleven females of various sizes and one small male, all preserved in an alcoholic solution of $HgCl_2$, and collected by myself at the Knysna in March, 1896. They occur in rotten wood in the forests and under weed-heaps, &c., on the farms near the town.

This is a very large and stout species, and differs markedly in colour from the other species of this section. The genital legs, too, are much better developed. The orange-brown pigment is only partially dissolved by spirits; the greater portion remains undissolved and the colour scarcely changes. I dedicate this handsome and distinct species, which rivals *capensis* in size, to Mr. Adam Sedgwick.

Other localities are :—

(a) Plettenberg Bay in the Knysna Division. Several very badly preserved specimens from this locality are recognisable as belonging to this species.

(b) Grahamstown. Two specimens, presented by Dr. Schönland, undoubtedly belong to this species and agree very closely with the types in colour and structure, excepting that the dorsal and lateral papillæ are longer and not so stumpy. A third specimen from the same bottle differs in the ground-colour of the dorsal surface, which is green instead of brown, with numerous large brown papillæ; the lateral bands are entirely brown. This specimen is doubtless merely a colour variety of *sedgwicki*.

A female captured at the end of March, 1896, at the Knysna contained a number of embryos of a very advanced stage of development, and evidently almost ready for birth. They already possessed five longitudinal green lines, corresponding to the dark ones of the adult, while the legs were also dark green.

10. PERIPATOPSIS CLAVIGERA, n. sp.

Characters.—Claw-bearing legs 17 pairs; the middle spinous pad very broad, 2·2–2·9 times as wide as the proximal pad.

The leg on each side of the genital opening in the female with the foot normally developed and slightly smaller than that of the pre-

ceding leg; the trunk very much reduced and scarcely as long as the foot; only the distal pad is present, although sometimes in a rudimentary condition, and between it and the body there is only one row of papillæ on the median side.

The papillæ on the dorsal and lateral surfaces of the body mostly flat-topped, cylindrical, or clavate, *many being enlarged in the distal part and constricted towards the middle or base.*

Length and width of largest ♀ (preserved in alc. sol. of HgCl₂ and contracted): $34 \times 4\frac{1}{2}$ mm.

Colour of preserved specimens (2½ years in spirits).—*Dorsal and lateral surfaces* dark green,* the lateral band on each side just above the bases of the legs lighter than the dorsal surface. The medio-dorsal and the lower lateral darker stripes distinct and similar to those of *balfouri*; the upper lateral dark stripe, however, distinctly defined only along its lower border and as thickly studded with orange papillæ as the rest of the dorsal surface. These papillæ evenly distributed over the whole surface (except in the medio-dorsal stripe) and also between the legs, resembling those of *balfouri* in colour but not becoming white in spirits.

Ventral surface more or less tinged with green in places, sometimes the greater part greenish. The papillæ with dark-green tips numerous; intermingled with them are a fewer number of pallid papillæ, which are broadly pallid round their bases and green-tipped in the darker specimens only. These pale papillæ correspond to the orange ones of the dorsal surface.

Legs.—Outer surface dark green with no, or at most one or two, orange papillæ to each leg. Under surface like the ventral side of body, but often paler. Spinous pads green, the proximal pad or the proximal part of the middle pad, or both sometimes yellowish.

Locality.—I collected four large females from rotten logs in the forest at Knysna.

This species is much rarer than *sedgwicki*, which inhabits the same locality and was also found in the same logs. It differs from all the other species of the genus in possessing the curious clavate papillæ of *Opisthopatus cinctipes* on the upper surface.

On dissecting a specimen of this species, captured at the end of March, 1896, I found the oviducts full of a number of very advanced

* These specimens were collected in March, 1896, and in August of the same year I referred to them as being of a black colour above (Trans. S. A. Phil. Soc., ix., p. xviii, 1897). The change to dark green is quite the usual one, and the original colour was probably a greenish black, which agrees very well with my recollections of the living animal.

embryos, evidently almost ready for birth. In the intestinal canal of the same specimen was the empty skin of another, which had been swallowed whole, and to which the jaws and some of the claws of the legs were still attached.

The following form of this section is unknown to me :—

11. PERIPATOPSIS, spec. nov. (?)

Sedgwick, A Monograph on the spec. and distr. of the genus *Peripatus*, Guild., *loc. cit.*

On p. 169 of the reprint this form is described as a specimen from Table Mountain with 20 pairs of claw-bearing legs, and closely resembling *balfouri* in colour and structure. The last pair of legs, between which the genital opening lies, has a normal foot but no spinous pads, and is much reduced in size. Sedgwick places this form provisionally as a variety of *balfouri*.

GEN. OPISTHOPATUS, nov.

Type *O. cinctipes*, n. sp.

Characters.—As in *Peripatopsis* except: The leg on each side of the genital opening not rudimentary, as large and as well developed as the preceding pair and probably used for walking. Foot with a single anterior, a posterior, and a dorsal papilla, all of which are large and near the apex. Genital opening in the form of a transverse slit, a little remote from the hind end of the body.

Male unknown.

In the female specimen which I opened the oviducts resemble those of *P. capensis* in being unprovided with *receptacula seminis*. They differ, however, in containing a number of embryos of different stages of development, the one immediately before the external opening being much larger than any of the others in the same oviduct. Evidently the young are born at remote intervals, and not all within a short period as in *Peripatopsis*. With regard to the position of the organs in the posterior half of the body, it may be mentioned that the intestinal canal was pressed against the left side of the body and slightly ventral; the portion of the right oviduct containing the large embryo nearest the opening lay along the ventral body-wall, while the left oviduct with its large embryo lay above the right one, just under the dorsal wall of the body, crossing over the intestinal canal near its posterior end.

The narrow slit-like genital opening is raised on an eminence and is situated at some little distance from the anus and hind end of the body, which projects some distance beyond the last pair of legs. In this respect the genus bears some apparent resemblance to the condition which obtains in the Australasian species.

The dorsal surface is provided with a fine median white line, and the outer jaws, like those of *Peripatopsis*, possess a small accessory tooth at the base of the main tooth.

This genus to some extent resembles the Australasian species of *Peripatoides*, in which the papillæ of the feet are similarly arranged, and the genital opening is also situated between the last pair of fully developed legs. It differs, however, in having a transverse genital opening, and in the absence of *receptacula seminis* in the female.

Only the following species is known :—

12. OPISTHOPATUS CINCTIPES, n. sp.

Characters.—Claw-bearing legs 16 pairs; the middle spinous pad broad, two to three times as wide as the proximal pad. Papillæ of dorsal and lateral surfaces cylindrical or clavate, many of them being enlarged in the distal part and constricted towards the middle or base, mostly flat-topped at apex.

Length of spirit specimen 21 mm., breadth $3\frac{1}{2}$ mm.

Colour of spirit specimens.—*Dorsal and lateral surfaces* very dark green, the lateral band on each side just above the bases of the legs paler green. The ordinary papillæ very dark, almost black in the distal part, the orange-brown papillæ scattered amongst these in the same proportion as in *P. balfouri*, with or without dark green round the tips. Dark medio-dorsal stripe distinct, divided longitudinally in places by a fine white line.

Outer surface of *legs* and the sides of the body between the legs dark green, with numerous dark-green papillæ and a small number of orange-brown ones. Ventral surface of legs peculiarly marked with transverse bands of pale papillæ, alternating with similar bands of dark-green ones. Spinous pads green, the proximal pad and the proximal part of the middle pad generally yellowish.

Ventral surface of body pallid, pigmented with dark green in the pores at the bases of the legs, and, in one specimen, on an irregular median area behind each pair of legs. Numerous more or less dark-green papillæ are scattered over the whole surface.

Locality.—Two specimens (one of which on opening proved to be a female) from Dunbrody, near Blue Cliff Station, Uitenhage Div. (*Rev. J. A. O'Neil*, 1898).

The following form of uncertain position is unknown to me:—

PERIPATUS BREVIS, Blainville.

Page 8 of Gervais' *Etude pour servir a l'histoire natur. des Myriap.*, in: *Ann. Sci. Nat.* (2), vii., 1837.

Black above, pallid below, with 14 pairs of legs; length 43 mm., breadth 4 mm. Found under a stone in a wood on Table Mountain. (Quoted from Sedgwick, 1898.) Moseley considers this species to be *capensis* badly described. The circumstance that it appears never to have been found again certainly lends colour to this view.

Synopsis of the named South African Species.

A.—Genital opening longitudinal, situated between a pair of rudimentary (sometimes quite obsolete) legs Gen. PERIPATOPSIS, Poc.

a. These legs with neither claws nor rudiments of feet.

a¹. Seventeen pairs of claw-bearing legs. Cape Penin. *P. capensis* (Grube).

b¹. Twenty-one to twenty-two pairs of claw-bearing legs. King William's Town and Natal. *P. moseleyi* (Wood-M.).

b. These legs with normal feet and claws.

a². None of the dorsal and lateral papillæ clavate.

a³. Eighteen pairs of claw-bearing legs. Cape Penin., Clanwilliam. *P. balfouri* (Sedgw.).

b³. Twenty-one to twenty-two pairs of claw-bearing legs. Cape Penin. *P. leonina*, n. sp.

c³. Twenty pairs of claw-bearing legs. Knysna, Graham's Town. *P. sedgwicki*, n. sp.

b². Many of the papillæ of the upper surface of body clavate, being enlarged in the apical part; seventeen pairs of claw-bearing legs. Knysna. *P. clarigera*, n. sp.

B.—Genital opening a transverse slit situated between the last pair of legs, which are normal and not reduced in size Gen. OPISTHOPATUS, nov.

Claw-bearing legs sixteen pairs. Uitenhage Div. . . . *O. cinctipes*, n. sp.

Doubtful species with fourteen pairs of legs. Table Mountain.

Peripatus brevis, Blainv.